Intercomparisons tests for surface waters and biological material

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Water laboratory, Lapland regional environment centre Finnish Lapland. Photograph: Markku Örn

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1. Intercomparisons tests for surface waters and biological material

One of the goals in the project is to integrate the monitoring activities in the three countries, and to improve and harmonize the monitoring routines and methodology used in evaluating the effects of emissions on freshwater ecosystems in the border area. Two laboratory intercomparison tests were arranged in 2004 in order to reach this goal. The main purpose of the intercomparison tests was to evaluate the comparability of the analysis results produced by the environment laboratories in the Kola area, as well as to estimate the overall results of cooperation in the neighbouring regions. With the help of the participation of the Finnish laboratories, a wider comparison base was developed for the handling of the results and for drawing conclusions.

Before the statistical handling of the results, the results of those laboratories which differed significantly from the other results were excluded on the basis of the Grubbs test. The mean value calculated from the test results was used as the assigned value in all the analyses. The standard deviations were also calculated by means of the Grubbs test.

The z value was calculated in order to better evaluate and understand the results. The z value was calculated using the formula $z = (x-X) / s$.

where:
x = result obtained by an individual laboratory
X = mean value of the results from all the laboratories (after the Grubbs test)
s = target value of the standard deviation in the ?content/concentration? in question (s = X * target deviation %)

The target deviations (3-20 %) of corresponding intercomparison tests, carried out by SYKE, were used as the target deviation of the tests. Thus the analytical level of the laboratories is compared directly with the level obtained by Finnish laboratories.

On the basis of the z value, the results of the laboratories can be estimated as follows:

- accepted, when $|z| < 2$
- questionable, when $2 \leq |z| \leq 3$
- unsatisfactory, when $|z| > 3$

The result of a laboratory is accepted if it differs from the calculated mean value by less than two times the target deviation (%).

1.1 Intercomparison test for surface waters

- *Lapland Regional Environment Centre*

A total of 16 laboratories from Finland, Norway and Russia took part in the intercomparison test organized by the Lapland Regional Environment Centre in November 2004. Samples of river and lake water collected in the Rovaniemi district were used as material for the analyses in the test. The following variables were to be determined on the samples:

- pH, conductivity, and the NO_2+NO_3, NH_4, Cl, PO_4 and Fe concentrations

- *The Finnish Environment Institute*

A total of 72 laboratories from Finland, Norway and Russia took part in the intercomparison test organised by the Finnish Environment Institute (SYKE) in autumn 2004. Samples of River and lake water and synthetic samples were used as material for the analyses in the test. The following variables were to be determined on the samples:

- Al, As, B, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Sb, Sr, and Zn concentrations

1.1.1 Results and conclusions

- *Lapland Regional Environment Centre*

As regards the level of the analyses, certain deviation was noticed among them. Most of the laboratories were relatively successful in the test, while some of the laboratories had more variation in their results. There were a few rejected results among the results from the latter laboratories, but they were only individual results and there were no systematic errors in their results. The determination of pH, conductivity, Cl, PO_4 and Fe were mainly analyzed acceptably. The average proportion of accepted results in these analyses were over 80 %. Problems were encountered with NO_2+NO_3 and NH_4 analyses, the average proportion of accepted results being 50-60 %.

- *The Finnish Environment Institute*

Most of the laboratories were relatively successful in the test. The average proportion of accepted results for the co-operating laboratories was 70-100 %, and for all the laboratories participating in the test was 88 %. The average proportion for accredited laboratories was 91 %.

1.2 Intercomparison test for biological material

A total of 6 laboratories from Finland, Norway and Russia took part in the intercomparison test, organised by the Lapland Regional Environment Centre in October 2004. Samples of Synthetic material and white fish and pike were used as material for the analyses in the test. The following variables were to be determined on the samples:
- Hg, As, Cd, Cu, Ni, Pb and Zn concentrations

1.2.1 Results and conclusions

The most numerous problems were associated with the analysis of certain heavy metals, the number of accepted results being relatively limited. This was due to the small number of laboratories carrying out the analyses in question. Moreover, exact determination of the variation and the mean value, used as a basis for evaluating the results, was difficult. Therefore the statistical estimations for these heavy metal analyses can be regarded as indicative only.

There was very much variation between the analyses results in the test. The synthetic material was, overall, analyzed acceptably, but the accurate determination of smaller concentrations in the fish samples proved to be very difficult. The average proportion of accepted results for the fish samples was 50 %, which is an alarmingly low value.

1.3 Recommendations for future work

On the basis of the results of the intercomparison test, further cooperation between the laboratories is considered necessary. The most important points are the development of a quality control system in which the standards and methods related to quality control are handled.

- *intercomparison test for the laboratories*
- *cooperation and training in analysis methods and practices*
- *method standardization between the laboratories cooperating in the monitoring programme*
- *cooperation and training in sampling methods and sample preparation*
- *a manual for integrated monitoring*